

Carmen Johnson

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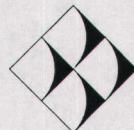
Ground Water Monitoring Report

September 2003 Monitoring Event

**Red Rock Construction & Demolition Debris Landfill
Holly Springs, North Carolina
NC Solid Waste Permit # 92-28**

Prepared for:
Waste Industries, Inc.
3301 Benson Drive Suite 601
Raleigh, NC 27609

January 2004



G.N. Richardson & Associates, Inc.
Engineering and Geological Services
14 North Boylan Avenue
Raleigh, North Carolina 27603

Red Rock C&D Landfill
Ground Water Monitoring Report
September 2003 Monitoring Event

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1.0 Introduction

On September 23rd 2003, Environment 1 Laboratory personnel performed the required semi-annual detection monitoring ground water sampling event at the Red Rock C&D Landfill. This sampling event satisfies the requirements of the detection monitoring program under Solid Waste Permit # 92-28. The following report summarizes the monitoring event, sampling procedures, field and laboratory results, and ground water characterization as required by NC Solid Waste Regulations. Also included are summary tables of ground water measurements, field parameters, and detected constituents, and the laboratory analytical report.

2.0 Sampling Procedures

Ground water sampling was performed at 7 well locations. In addition, semi-annual surface water monitoring was performed at two (2) locations down stream of the landfill and one upstream location. The monitoring locations are shown on **Figure 1**.

Sampling procedures followed the protocols set forth in the site's Water Quality Monitoring Plan and the North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities. Each well was gauged to determine ground water depth and then purged of three to five well volumes or until dry. The wells were purged and allowed to stabilize prior to sample collection. Ground water purging and sample collection were performed using a laboratory cleaned, dedicated, bailer.

Field measurements of pH, specific conductivity, temperature, and turbidity were taken at each well and surface water sampling location. Field meters were calibrated prior to sampling. Samples were collected in laboratory containers provided by Environment 1, Inc. (NC Laboratory Certification # 10). Upon collection, the samples were sealed, placed on ice, and transported to the laboratory. Field blanks were also collected for quality control purposes.

During the sampling process, each well was inspected for signs of damage or unusual conditions. All wells were found to be in good condition and free of obstructions.

Samples from surface water points SW-1, SW-2 and SW-3 were collected during ground water sample collection. The surface water locations are show in **Figure 1**.

3.0 Field and Laboratory Results

All samples were transported to the laboratory facility under proper chain of custody analyzed at the specified DWM Practical Quantitation Limits for Appendix I constituents. The laboratory analysis is included in **Appendix A**.

Ground water and field measurements are included as **Tables 1 and 2** respectively. The laboratory analysis detected no Appendix I organic compounds. Inorganic laboratory analysis

detected one inorganic constituent (barium) in the ground water samples (Table 3). This is likely due to turbidity in the water from the wells.

Analysis of surface water samples indicated detectable levels of lead in SW-2.

4.0 Ground Water Characterization

A potentiometric surface map was prepared from ground water elevation data collected in September 2003. Ground water velocity was calculated for each monitoring well on-site using the equation $V = (KI)/n$ where:

K = hydraulic conductivity

I = ground water gradient

n = porosity

Ground water velocities ranged from 3.688E-02 feet/day (MW-10) to 1.335E+00 feet/day (MW-3). These calculations are included in **Table 4**. Ground water at the C&D landfill is migrating toward the south, east and west. The potentiometric surface for the C&D landfill is included as **Figure 1**.

5.0 Conclusions

The results of this monitoring event confirm that the ground water quality around the Red Rock C&D Landfill has not been impacted by the facility. The detected inorganic results are likely due to naturally occurring suspended solids in the samples.

The next detection monitoring event is tentatively scheduled for March 2004. The results of this event will be included in the Spring Ground Water Monitoring Report. These samples will be analyzed for the full suite of Appendix I constituents.

Table 1
Ground Water Elevations
Red Rock C&D Landfill
09/23/03

Well	Top of Casing	Depth to Water	Water Table Elevation
MW-1	280.60	7.00	273.60
MW-2T	281.19	43.87	237.32
MW-3	261.80	11.88	249.92
MW-4	254.10	3.24	250.86
MW-5	254.47	3.65	250.82
MW-6T	289.21	13.97	275.24
MW-10	301.16	12.90	288.26

Table 2
Field Parameters
Red Rock C&D Landfill
09/23/03

Well	pH (std units)	Sp. Conductivity (uS)	Temperature (degrees C)
MW-1	6.7	4059 ✓	22
MW-2T	7.4	1692 ✓	17
MW-3	6.9	3088 ✓	19
MW-4	5.2	141	21
MW-5	4.5	247	20
MW-6T	7.3	3015 ✓	20
MW-10	6.1	622	19
SW-1	5.1	55	22
SW-2	5.2	116	22
SW-3	5.1	128	21

Table 4
Ground Water Velocity Calculations
Red Rock C&D Landfill
09/23/03

Parameter Units	Hydraulic Conductivity feet/min	Porosity %	Hydraulic Gradient feet/foot	Velocity feet/min	Velocity feet/day
MW-1	3.760E-04	0.10	0.028	1.053E-04	1.516E-01
MW-2T	NA	0.10	0.028	NA	NA
MW-3	5.150E-03	0.10	0.018	9.270E-04	1.335E+00
MW-4	NA	0.10	0.012	NA	NA
MW-5	1.430E-04	0.10	0.020	2.860E-05	4.118E-02
MW-6T	NA	0.10	0.032	NA	NA
MW-10	1.970E-04	0.10	0.013	2.561E-05	3.688E-02

Notes Velocity calculated from $V=KI/n$
 V = Velocity
 K = Hydraulic Conductivity
 I = Gradient
 n = Porosity
 Hydraulic conductivity data from slug testing

Table 4
Detected Constituents
Red Rock C&D Landfill
09/23/03

Detected Constituents				Wells			
	NC PQL	NC 2L		MW-1	MW-2T	MW-3	MW-6T
Barium	500	2000		1046	ND	2090	1066
Lead	10	15		ND	ND	ND	ND

All results in ppb

Appendix A

Environment 1, Incorporated

P.O. BOX 7085, 114 OAKMONT DRIVE
GREENVILLE, N.C. 27835-7085

PHONE (252) 756-6208
FAX (252) 756-0633

Drinking Water ID: 37715

Wastewater ID: 10

ID#: 6011

RED ROCK LANDFILL (C&D)
MS. JOAN SMYTH
G.N. RICHARDSON & ASSOCIATES
14 N. BOYLAN AVENUE
RALEIGH , NC 27603

DATE COLLECTED: 09/23/03
DATE REPORTED : 10/27/03

REVIEWED BY: 

PARAMETERS	Monitoring Well #1	Monitoring Well #2T	Monitoring Well #3	Monitoring Well #4	Monitoring Well #5	Analysis Date	Analyst	Method Code
PH (field measurement), Units	6.7	7.4	6.9	5.2	4.5	09/23/03	RJH	EPA150.1
Arsenic, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/02/03	WNG	EPA7060
Barium, mg/l	1.046	<0.500	2.090	<0.500	<0.500	10/24/03	LFJ	EPA200.7
Cadmium, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	10/10/03	WNG	EPA7131
Total Chromium, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/08/03	LFJ	EPA200.7
Lead, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/03/03	WNG	EPA7421
Mercury, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	10/01/03	LFJ	EPA7470
Selenium, mg/l	<0.020	<0.020	<0.020	<0.020	<0.020	10/13/03	WNG	EPA7740
Silver, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/07/03	LFJ	EPA200.7
Conductivity (at 25c), uMhos	4059 -?	1692 -?	3088 -?	141	247	09/23/03	RJH	SM2510B
Temperature, °C	22	17	19	21	20	09/23/03	RJH	SM2550B
Static Water Level, Feet	7.00	43.87	11.88	3.24	3.65	09/23/03	RJH	
Well Depth, feet	19.89	80.56	31.18	17.38	16.34	09/23/03	RJH	

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DATE COLLECTED: 09/23/03
DATE REPORTED : 10/27/03

REVIEWED BY:

PARAMETERS	Monitoring Well #6T	Monitoring Well #10	Surface Water #1	Surface Water #2	Surface Water #3	Analysis Date	Analyst	Method Code
PH (field measurement), Units	7.3	6.1	5.1	5.2	5.1	09/23/03	RJH	EPA150.1
Arsenic, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/02/03	WNG	EPA7060
Barium, mg/l	1.066	<0.500	<0.500	<0.500	<0.500	10/24/03	LFJ	EPA200.7
Cadmium, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	10/10/03	WNG	EPA7131
Total Chromium, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/08/03	LFJ	EPA200.7
Lead, mg/l	<0.010	<0.010	<0.010	0.015	<0.010	10/03/03	WNG	EPA7421
Mercury, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	10/01/03	LFJ	EPA7470
Selenium, mg/l	<0.020	<0.020	<0.020			10/13/03	WNG	EPA7740
Silver, mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	10/07/03	LFJ	EPA200.7
Conductivity (at 25c), uMhos	3015 -?	622	55	116	128	09/23/03	RJH	SM2510B
Temperature, °C	20	19	22	22	21	09/23/03	RJH	SM2550B
Static Water Level, Feet	13.97	12.90				09/23/03	RJH	
Well Depth, feet	47.34	34.15				09/23/03	RJH	

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CLIENT ID: 6011
ANALYST: MAO
DATE COLLECTED: 09/23/03 Page: 1
DATE REPORTED: 10/27/03

REVIEWED BY:

VOLATILE ORGANICS
EPA METHOD 8260B

PARAMETERS, ug/l	Date Analyzed:	09/25/03 Monitoring Well #1	09/25/03 Monitoring Well #2T	09/25/03 Monitoring Well #3	09/25/03 Monitoring Well #4	09/25/03 Monitoring Well #5
1. Chloromethane		<10.00	<10.00	<10.00	<10.00	<10.00
2. Vinyl Chloride		<10.00	<10.00	<10.00	<10.00	<10.00
3. Bromomethane		<10.00	<10.00	<10.00	<10.00	<10.00
4. Chloroethane		<10.00	<10.00	<10.00	<10.00	<10.00
5. Trichlorofluoromethane		<5.00	<5.00	<5.00	<5.00	<5.00
6. 1,1-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
7. Acetone		<100.00	<100.00	<100.00	<100.00	<100.00
8. Iodomethane		<10.00	<10.00	<10.00	<10.00	<10.00
9. Carbon Disulfide		<100.00	<100.00	<100.00	<100.00	<100.00
10. Methylene Chloride		<10.00	<10.00	<10.00	<10.00	<10.00
11. trans-1,2-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
12. 1,1-Dichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
13. Vinyl Acetate		<50.00	<50.00	<50.00	<50.00	<50.00
14. Cis-1,2-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
15. 2-Butanone		<100.00	<100.00	<100.00	<100.00	<100.00
16. Bromochloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
17. Chloroform		<5.00	<5.00	<5.00	<5.00	<5.00
18. 1,1,1-Trichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
19. Carbon Tetrachloride		<10.00	<10.00	<10.00	<10.00	<10.00
20. Benzene		<5.00	<5.00	<5.00	<5.00	<5.00
21. 1,2-Dichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
22. Trichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
23. 1,2-Dichloropropane		<5.00	<5.00	<5.00	<5.00	<5.00
24. Bromodichloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
25. Cis-1,3-Dichloropropene		<10.00	<10.00	<10.00	<10.00	<10.00
26. 4-Methyl-2-Pentanone		<100.00	<100.00	<100.00	<100.00	<100.00
27. Toluene		<5.00	<5.00	<5.00	<5.00	<5.00
28. trans-1,3-Dichloropropene		<10.00	<10.00	<10.00	<10.00	<10.00
29. 1,1,2-Trichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
30. Tetrachloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
31. 2-Hexanone		<50.00	<50.00	<50.00	<50.00	<50.00
32. Dibromochloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
33. 1,2-Dibromoethane		<5.00	<5.00	<5.00	<5.00	<5.00
34. Chlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
35. 1,1,1,2-Tetrachloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
36. Ethylbenzene		<5.00	<5.00	<5.00	<5.00	<5.00
37. Xylenes		<5.00	<5.00	<5.00	<5.00	<5.00
38. Dibromomethane		<10.00	<10.00	<10.00	<10.00	<10.00
39. Styrene		<10.00	<10.00	<10.00	<10.00	<10.00
40. Bromoform		<5.00	<5.00	<5.00	<5.00	<5.00
41. 1,1,2,2-Tetrachloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
42. 1,2,3-Trichloropropene		<15.00	<15.00	<15.00	<15.00	<15.00
43. 1,4-Dichlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
44. 1,2-Dichlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
45. 1,2-Dibromo-3-Chloropropane		<25.00	<25.00	<25.00	<25.00	<25.00
46. Acrylonitrile		<200.00	<200.00	<200.00	<200.00	<200.00
47. trans-1,4-Dichloro-2-Butene		<100.00	<100.00	<100.00	<100.00	<100.00

Environment 1, Incorporated

Drinking Water ID: 37715
Wastewater ID: 10

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RALEIGH, NC 27603

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ANALYST: MAO
DATE COLLECTED: 09/23/03 Page: 2
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REVIEWED BY:

VOLATILE ORGANICS
EPA METHOD 8260B

PARAMETERS, ug/l	Date Analyzed:	09/25/03 Monitoring Well #6T	09/25/03 Monitoring Well #10	09/25/03 Surface Water #1	09/25/03 Surface Water #2	09/26/03 Surface Water #3
1. Chloromethane		<10.00	<10.00	<10.00	<10.00	<10.00
2. Vinyl Chloride		<10.00	<10.00	<10.00	<10.00	<10.00
3. Bromomethane		<10.00	<10.00	<10.00	<10.00	<10.00
4. Chloroethane		<10.00	<10.00	<10.00	<10.00	<10.00
5. Trichlorofluoromethane		<5.00	<5.00	<5.00	<5.00	<5.00
6. 1,1-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
7. Acetone		<100.00	<100.00	<100.00	<100.00	<100.00
8. Iodomethane		<10.00	<10.00	<10.00	<10.00	<10.00
9. Carbon Disulfide		<100.00	<100.00	<100.00	<100.00	<100.00
10. Methylene Chloride		<10.00	<10.00	<10.00	<10.00	<10.00
11. trans-1,2-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
12. 1,1-Dichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
13. Vinyl Acetate		<50.00	<50.00	<50.00	<50.00	<50.00
14. Cis-1,2-Dichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
15. 2-Butanone		<100.00	<100.00	<100.00	<100.00	<100.00
16. Bromochloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
17. Chloroform		<5.00	<5.00	<5.00	<5.00	<5.00
18. 1,1,1-Trichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
19. Carbon Tetrachloride		<10.00	<10.00	<10.00	<10.00	<10.00
20. Benzene		<5.00	<5.00	<5.00	<5.00	<5.00
21. 1,2-Dichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
22. Trichloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
23. 1,2-Dichloropropane		<5.00	<5.00	<5.00	<5.00	<5.00
24. Bromodichloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
25. Cis-1,3-Dichloropropene		<10.00	<10.00	<10.00	<10.00	<10.00
26. 4-Methyl-2-Pentanone		<100.00	<100.00	<100.00	<100.00	<100.00
27. Toluene		<5.00	<5.00	<5.00	<5.00	<5.00
28. trans-1,3-Dichloropropene		<10.00	<10.00	<10.00	<10.00	<10.00
29. 1,1,2-Trichloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
30. Tetrachloroethene		<5.00	<5.00	<5.00	<5.00	<5.00
31. 2-Hexanone		<50.00	<50.00	<50.00	<50.00	<50.00
32. Dibromochloromethane		<5.00	<5.00	<5.00	<5.00	<5.00
33. 1,2-Dibromoethane		<5.00	<5.00	<5.00	<5.00	<5.00
34. Chlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
35. 1,1,1,2-Tetrachloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
36. Ethylbenzene		<5.00	<5.00	<5.00	<5.00	<5.00
37. Xylenes		<5.00	<5.00	<5.00	<5.00	<5.00
38. Dibromomethane		<10.00	<10.00	<10.00	<10.00	<10.00
39. Styrene		<10.00	<10.00	<10.00	<10.00	<10.00
40. Bromoform		<5.00	<5.00	<5.00	<5.00	<5.00
41. 1,1,2,2-Tetrachloroethane		<5.00	<5.00	<5.00	<5.00	<5.00
42. 1,2,3-Trichloropropene		<15.00	<15.00	<15.00	<15.00	<15.00
43. 1,4-Dichlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
44. 1,2-Dichlorobenzene		<5.00	<5.00	<5.00	<5.00	<5.00
45. 1,2-Dibromo-3-Chloropropane		<25.00	<25.00	<25.00	<25.00	<25.00
46. Acrylonitrile		<200.00	<200.00	<200.00	<200.00	<200.00
47. trans-1,4-Dichloro-2-Butene		<100.00	<100.00	<100.00	<100.00	<100.00

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Page: 3

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VOLATILE ORGANICS
EPA METHOD 8260B

PARAMETERS, ug/l	Date Analyzed: 09/25/03 Trip Blank
1. Chloromethane	<10.00
2. Vinyl Chloride	<10.00
3. Bromomethane	<10.00
4. Chloroethane	<10.00
5. Trichlorofluoromethane	<5.00
6. 1,1-Dichloroethene	<5.00
7. Acetone	<100.00
8. Iodomethane	<10.00
9. Carbon Disulfide	<100.00
10. Methylene Chloride	<10.00
11. trans-1,2-Dichloroethene	<5.00
12. 1,1-Dichloroethane	<5.00
13. Vinyl Acetate	<50.00
14. Cis-1,2-Dichloroethene	<5.00
15. 2-Butanone	<100.00
16. Bromochloromethane	<5.00
17. Chloroform	<5.00
18. 1,1,1-Trichloroethane	<5.00
19. Carbon Tetrachloride	<10.00
20. Benzene	<5.00
21. 1,2-Dichloroethane	<5.00
22. Trichloroethene	<5.00
23. 1,2-Dichloropropane	<5.00
24. Bromodichloromethane	<5.00
25. Cis-1,3-Dichloropropene	<10.00
26. 4-Methyl-2-Pentanone	<100.00
27. Toluene	<5.00
28. trans-1,3-Dichloropropene	<10.00
29. 1,1,2-Trichloroethane	<5.00
30. Tetrachloroethene	<5.00
31. 2-Hexanone	<50.00
32. Dibromochloromethane	<5.00
33. 1,2-Dibromoethane	<5.00
34. Chlorobenzene	<5.00
35. 1,1,1,2-Tetrachloroethane	<5.00
36. Ethylbenzene	<5.00
37. Xylenes	<5.00
38. Dibromomethane	<10.00
39. Styrene	<10.00
40. Bromoform	<5.00
41. 1,1,2,2-Tetrachloroethane	<5.00
42. 1,2,3-Trichloropropane	<15.00
43. 1,4-Dichlorobenzene	<5.00
44. 1,2-Dichlorobenzene	<5.00
45. 1,2-Dibromo-3-Chloropropane	<25.00
46. Acrylonitrile	<200.00
47. trans-1,4-Dichloro-2-Butene	<100.00

CHAIN OF CUSTODY RECORD

Phone (252) 756-6208 • Fax (252) 756-0633

CLIENT: 6011 Week: 38

RED ROCK LANDFILL (C&D)
MS. JOAN SMYTH
G.N. RICHARDSON & ASSOCIATES
14 N. BOYLAN AVENUE
RALEIGH NC 27603

(919) 828-0577

		DISINFECTION		CHLORINE		CHLORINE NEUTRALIZED AT COLLECTION																																																																																																									
		<input type="checkbox"/> UV		<input checked="" type="checkbox"/> NONE		<input type="checkbox"/> pH CHECK (LAB)																																																																																																									
						CONTAINER TYPE, P/G																																																																																																									
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						<input type="checkbox"/> A - NONE <input type="checkbox"/> D - NaOH <input type="checkbox"/> B - HNO ₃ <input type="checkbox"/> E - HCl <input type="checkbox"/> C - H ₂ SO ₄ <input type="checkbox"/> F - ZINC ACETATE <input type="checkbox"/> G - NATHIOSULFATE																																																																																																									
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Instructions for completing this form are on the reverse side.

Sampler must place a "C" for composite sample or a "G" for
Grab sample in the blocks above for each parameter requested. № 95538